

ICT in Food Processing Industry

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Abstract. Food industry is currently introducing fully automated production, similar to automotive industry for example. The food processing is a traditional part of processing industry of the Czech Republic, mostly due to the strategic nutritional needs of the population with the requirements for food quantity and quality. Information and communication technologies are today's phenomenon. It is a field developing highly dynamically and the development of the technologies is related to noticeable changes to the functioning of the post-modern society. The aim of the paper is to discuss the use of information technologies in the food industry in the Czech Republic with a focus on different parts of information systems. Using Mann-Whitney U-test and Person χ^2 test, different characteristics were tested for a sample of 52 enterprises. The results for example did not confirm the research of the Czech Statistical Office from 2018, saying that ICT (information and communication technologies) outsourcing is mostly used by large and middle-sized enterprises.

Keywords: food industry; ICT; outsourcing; ERP; CRM; Czech Republic

JEL Classification: M15; L86; M11

1. Literature Review

By Adamczewski (2016), information and communication technology are a key part of the world economy and social changes. ICT industry keeps increasing its trend share and it is an important factor of the global economic efficiency; different ICT solutions are the basis for entry into the development phase known as the information society in the case of modern organizations for which the advanced structure of ICT is a prerequisite for their effective management.

In the corporate sector, globalization is manifested primarily by the growth of multinational corporations and ICT with the ability to build large corporate networks, connecting the enterprises with the help of the Internet in the framework of global corporations. With the introduction of new technologies, enterprise information systems are created, connecting subsidiaries into international corporations, in many areas such as logistics, strategic purchasing of materials, building their own sales channels and management accounting (Volek et al. 2015).

Gála (2006) says that business informatics should primarily respond to business needs. It must provide the results and effects significant for the company on the market and at the same time adequate in relation to the investments made in it. To do so, it is important that IT specialists and qualified users accurately formulate their requirements, define their content, and work together on organizational, operational, and other business informatics elements. Informatics has become a common part of economic and business transactions, analyses, marketing and manufacturing technologies. The most important part of the current developments in informatics is related to its gradual integration into various business areas and everyday human activities. With a view to a qualified assessment of the level of enterprise informatics, it is necessary to define the basic demands on performance and its quality that it should bring to businesses.

Food production is a traditional part of processing industry of the Czech Republic, mostly due to the strategic nutritional needs of the population with the requirements for food quantity and quality (Puticová and Mezera 2008). By CZ-NACE, food industry is classified as section 10, further divided into nine sub-sections.

Figure 1 shows the share of each subgroup on the whole section, in percentages by revenue. The food industry is currently trying to produce fully automated production, similar to, for example, automotive production. However, there are some major differences.

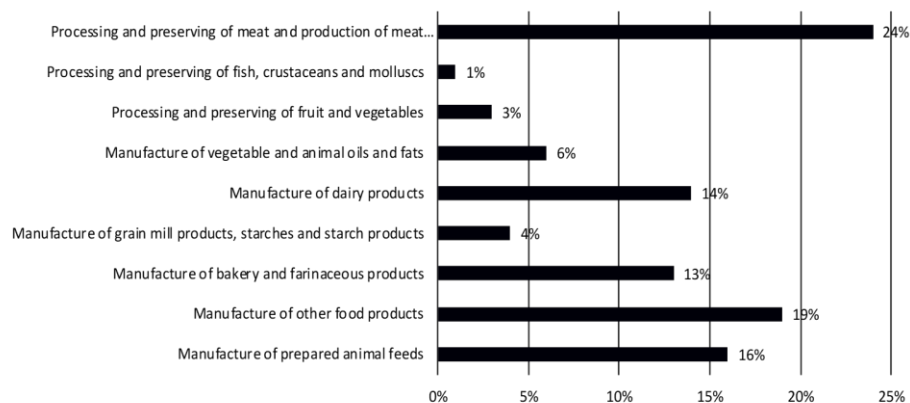


Figure 1. Sub-group shares in Section 10 by revenue. (Mezera, Plášil, and Náglová 2018)

The issue, related to automation in the enterprises, is the complexity of information systems. The information system in the food industry must ensure not only the traceability of "components", but also monitor expiration, sample storage, batching, environmental monitoring and compliance with HACCP (Vokoun et al. 2015). Often, the enterprises are forced to install additional support information systems to ensure activity management and reliable operation.

In relation to ICT, 79.6% of the enterprises are equipped with an internal computer network and nearly 100% of the enterprises have Internet access. Manufacturing is a leader in robotics and 0.9% of employees are IT professionals. Bartoš (2017) notices that there are issues in the food industry enterprises in relation to Industry 4.0. In this case, as production lines should decide to start work, and be able to check the availability of raw materials for the product, the problem is that the raw materials in the food industry are often either free-flowing loose or liquid, and are very difficult to be provided with RFID chips (Kunal et al. 2009). Such problem is often solved by using containers provided with the chips easily (Ruiz-Garcia et al. 2018)

Another issue might be related to the equipment used in an enterprise. Often, the desired intelligent communication between an enterprise information system and production technology does not occur automatically, as currently used technologies often do not allow communication interfaces and need to be equipped with external sensors to provide information bridging technologies and enterprise information systems.

By Digital Development (2017), ICT include all technologies used to deal with information and communication. A similar term, IT (information technology) was complemented by an element of communication, given the ability of computers and other devices to communicate through a network.

With the development of such networks, the telecommunications infrastructure was digitized; at present, the difference between telecommunications and the Internet is primarily in the requirements for speed and reliability of data delivery. Technological progress is seen as a driver for economic growth and job creation, ICT transforms many aspects of world economies, governments and societies, even in developing countries, where public officials, citizens and businesses can leverage the transformational power of ICT to deliver more efficient services, support economic growth and strengthen social relations.

From the perspective of information system components, ERP (Enterprise Resource Planning) applications of manufacturing and trading enterprises are the most important part of enterprise informatics. They provide the enterprise with resource records, sales, purchases, and more. In addition to ERP applications, there is a number of other applications, known as Business Intelligence, implemented, significantly affecting the performance and efficiency of information systems (Duan and XU 2012). By Novotný, Pour, and Slánský (2005), Business Intelligence components include Executive Information Systems (EIS) that create their own multidimensional layer through which users access

the requested data. These are applications that incorporate all the most important data sources of the system relevant to the organization as a whole, they are analytical and presentation tools (Zadeh et al. 2018). These applications are designed with a view to future users – the managers who often do not have the knowledge of IT, this is what distinguishes these applications from other business intelligence tools. With the development of Internet infrastructure - ICT in general, individual information systems are interconnected with those of other businesses and business partners. These communications and collaborative ties have given rise to a group of e-Business applications, including e-commerce, supply, supply chain management, and mobile trading. The external part of the information systems consists of customer relationship management (CRM) applications that include business contact analysis, evidence, customer communication management, and the like (Hajiha et al. 2011). These parts of the IS can be used in as separate units - software, and as integrated parts of a complex IS, referred to as ERP II.

2. Methods

The aim of the paper is to describe the use of ICT in the food industry in the Czech Republic with a focus on different parts of information systems and outsourcing.

The sample consists of 52 enterprises of food industry. Data collection took place in 2017-2018 using a questionnaire survey, where twenty questions were used (using closed, dichotomous and scale question types). The overall return on the questionnaires was approximately 3.8% of the more than 1,300 businesses addressed, where the selection was based on the sub-groups of the food industry listed in Section 10 (see Figure 1).

The data were analyzed and an analysis of the current status of enterprises in the area of ICT was performed using statistical methods. Both descriptive statistics and three statistical tests (Mann-Whitney U-test and Pearson's χ^2) were used to analyze the current state. For a comprehensive analysis of the data, the results were in many cases compared with current research in the Czech Republic and abroad. Based on the mentioned researches, there were always formulated zero and alternative hypotheses. Regarding the description of the sample, there were 58% of small enterprises (<50 employees), 27% of middle-sized enterprises (<250) and 15% of large enterprises (>250 employees). The average number of employees in sample enterprises amounted to 156. In the classification of enterprises, depending on the type of market in which the business is located, a total of 23% consists of business to government markets. The largest group of enterprises (81%) is in business to consumer markets. The last group surveyed (50%) consists of businesses operating in business-to-business markets; however, the groups are intertwined as one enterprise can operate in multiple markets.

3. Results

At first, the relation of using information systems and the size of the enterprise was tested, Null hypothesis of non-existence of the difference between the number of employees of the enterprises using the information system and the number of employees not using it was tested by the Mann-Whitney U-test. In the sample, 83% of the enterprises use the information system, and the remaining 17% do not. All medium-sized and large enterprises use it. H_0 was rejected at a significance level of 0.05, in favour of H_A : the enterprises using the information system have more employees; and the resulting p-value was rather close to zero (0.001).

Table 1. Pearson χ^2 test – area of activity – different IS.

IS	χ^2	df	p-value	H_0
SAP	17.85859	df=1	p=.00002	rejected
Karat	.0049256	df=1	p=.94405	not rejected
Pohoda	.9083779	df=1	p=.34055	not rejected

In relation to the use of information systems, the participants were asked which system they use. The results show that the most common information systems in the food industry include SAP (15%), Karat (12%) and Pohoda (8%). Byznys, Edison, HELIOS, Ports, K2, Origis IT, SOFIX and Twist Inspore are used too, their share in the sample ranges between 4-6%. A total of 23% of the sample do not use a specific information system or do not use it at all.

Using the Pearson test, the relationship between the areas of competence of the enterprises (CR, Abroad) and the above-mentioned most frequently used information systems was tested. The prerequisite is that the enterprises using these systems operate also outside the Czech Republic because of the frequency of use of these information systems and the availability of language versions of these three information systems.

As revealed by the table above, null hypothesis was rejected in the enterprises using SAP on the basis of available data in favour of the alternative hypothesis assuming the dependence of both variables, at the significance level of $\alpha = 0.05$. In the case of users of the Karat and Pohoda systems, the level of significance failed to demonstrate the dependence proving the relation of the system and business areas.

Another part of the research was focused on components of information systems, which are used as standard in business practice. The figure below expresses the percentage representation as used by the food industry enterprises.

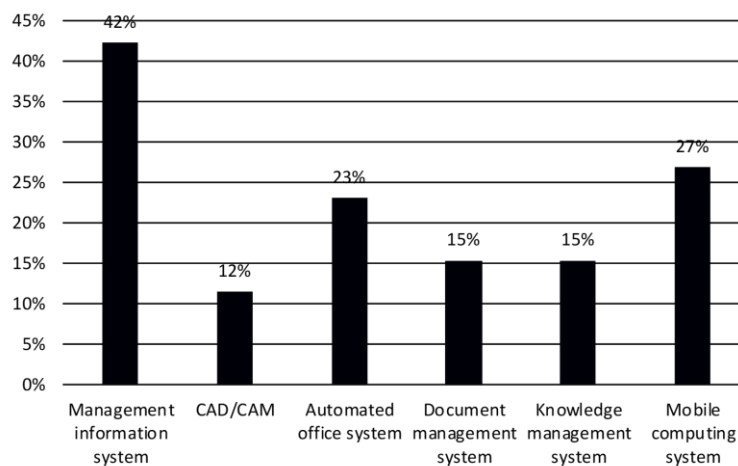


Figure 2. Data distribution - IS parts.

As seen from the figure above, a total of 42% of enterprises use a management information system, 27% of enterprises use a mobile computing system. CAD/CAM (Computer aided design/manufacturing) programs are the least used.

Surprisingly, despite the characteristics and the very nature of these programs - with regard to the food industry - this possibility has been reduced by only two percentage points less than, for example, the document management system. Mobile computing system was the second most common answer to the question "Which parts of the information system does your enterprise use daily?", answered by 27% of the participants.

The Czech Statistical Office also addressed the expansion of mobile computing systems and the use of portable devices with Internet access. Its data show that the number of enterprises using portable Internet-enabled devices has risen by 27% in six years. In terms of the use of ICT, it is equally important that the number of employees using these facilities grew adequately over the same time period by 11%.

Furthermore, the Czech Statistical Office's research showed that 82.7% of enterprises, excluding micro-enterprises, use portable devices with Internet access. If we focus on manufacturing, including food industry, the use of portable devices is lower by only 0.6% than the above figure for all the enterprises in the Czech Republic (expressed as a share of the total number of the enterprises in the sector).

Based on the research of the authors, time analysis and research of the Czech Statistical Office, growth in the use of mobile devices with Internet access is expected, and thus the increased use of mobile computing systems in the processing industry. Furthermore, data from the Czech Statistical Office (abbreviated as CZSO) showed that mobile devices with Internet access are more likely to be used by employees of the small enterprises (30%) than medium-sized and large (25%).

Table 2. Mann - Whitney U test – business area – different IS.

Number of employees	Sum of orders No	Sum of orders Yes	U	Z	p-value	H0
Small	356,0000	109,0000	56,00000	-0.803638	0.421607	Not-rejected
Medium-sized	98,00000	7,000000	4,000000	1.369306	0.170904	Not-rejected
Large	11,00000	25,00000	4,000000	0.500000	0.500000	Not-rejected

The assumption was set at the partial conclusion of the CZSO research for performing Mann - Whitney U test.

H0 – There is no difference in the number of enterprises using mobile devices with access to the Internet and those that do not use them.

HA: The enterprises that use mobile devices with connectivity have more employees.

Based on the available data, the null hypothesis denying the difference in the number of employees and the use of mobile devices with connectivity was not rejected in the group analysis at the selected significance level. Thus, the conclusions of the CZSO comprehensive research were not confirmed in the food industry.

Another part of the research was focused on outsourcing services related to ICT. 65% of our sample companies use outsourcing to manage IT. The Czech Statistical Office's research in 2018 dealt with the use of ICT in the business sector, and one of the findings of the research is the claim of using outsourcing in ICT areas rather than medium-sized and large enterprises. The partial conclusion of the research was established as the basis for the use of Mann-Whitney U-test.

Table 3. Mann - Whitney U test – enterprise size - outsourcing of ICT activities.

Sum of orders No	Sum of orders Yes	U	Z	p-value	H0
881,0000	497,0000	286,00000	0.37506	0.707311	Not-rejected

H0: There is no difference between the number of employees in enterprises that use the outsourcing of ICT-related activities and the number of employees that do not use it.

HA: Businesses that use outsourcing of ICT-related activities have more employees.

As shown in Table 3, the null hypothesis in favor of the alternative was not rejected at the selected significance level $\alpha = 0.05$. Unlike the above-mentioned research, it cannot be argued that outsourcing companies in the food industry have more employees than businesses that do not.

4. Conclusion

The data in the area of information systems show that IS is used in full by the medium-sized and large enterprises. The small enterprises do not use information systems in 100% of cases, this claim was also supported by statistical testing. The fact that not all small enterprises use IS is far from surprising.

However, it is necessary to note that the information system is not software solution only as the enterprises might think. The information system is not only a computer program, see the literature review, and it is therefore likely that although a certain percentage of small enterprises in the questionnaire said they did not use IS, they actually use a certain type of an information system. To support such statement, there is a part of an electronic documentation added to some answers: “we write orders manually, we don't have a code system in the stock, we do not post on Twitter and other social media.”

If we focus on different information systems used by the enterprises, as seen by a large number of IS used, the process of selecting a particular IS depends on personal preferences, economic possibilities, required functions and other variables not investigated.

Regarding the parts of information systems, the management information system are used by more companies than office systems. Although these components are closely linked, this is a positive phenomenon, as the management information system is a more comprehensive component and provides managers with important groundwork for future decision-making (Barthelemy 2004; Heiskanen 2008).

In relation to mobile computing systems in general, there is a growing number of portable devices with Internet access and their own computing system. However, today's digitalization is not an unexpected phenomenon. Positively, the mobile devices are used by medium-sized and large food enterprises, and also by small ones. Negatively can be viewed only 15% of the use of knowledge management systems. Given the fact that more than half of the enterprises are not considered knowledge-based businesses, the situation is all the more serious. The issue of outsourcing ICT-related activities is more than current. The data obtained and the data of the EU countries indicate that outsourcing is preferred to the employed IT specialists in the ICT field (Jalava and Pohjola 2011)

Surprisingly, this preference concerns businesses regardless of their size. In particular, food industry SMEs should take steps towards competitiveness. In the area of outsourcing ICT-related services, the enterprises should not rely on recruiting workers for information technology, but they should use the services of existing ICT-based businesses, as the data available suggest that they are faster, less costly and widely used (Amramovsky 2006; Versteeg 2006).

In addition, the enterprise should seek to change the main IS component from the automated office systems to management information systems that better match the characteristics of a competitive businesses. Emphasis on ecology and social responsibility is not a question for the enterprise but for their employees, who should contribute to sustainable development through their daily activities.

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